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Dynamics of energetic electrons and protons precipitation according to data from low-orbit satellites of the NOAA/POES and Meteor M2 during a magnetic storm on October 10-16, 2017

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Magnetic storm with SYM-H_{min}=-67 nT that was corresponded by series of substorms was observed on October 10-16, 2017. This interval began with the increase in the solar wind dynamic pressure to 10 nPa. In the middle of this interval, the solar wind speed reached 700 km/s. Intense auroral activity was characterized by increase of the AE index to 1916 nT. We analyzed data on the fluxes of relativistic (E > 800 keV) electron precipitation (REP) obtained by the low-orbit satellites NOAA/POES and Meteor M2. All REP events were divided into three groups according to the criterion presented in [1]. During this period, the POES satellites recorded 277 REP events. 99 events (35.7%) were of the first group (precipitation due to the geomagnetic field curvature). 124 events (44.8%) were of the second group (REP not related with energetic proton precipitation), and 54 events (19.5%) were of the third group (REP related with energetic proton precipitation). When the REP events of the 3rd group were recorded near the meridian of the Lovozero observatory, geomagnetic pulsations in the Pc1 range (0.2-5 Hz) were also recorded there. In the beginning of the geomagnetic disturbance, only REP of the 3rd group were observed. Their daily number peaked on October 11, and then gradually decreased. With the intensification of substorm activity, REP of the 2nd group began to appear. Their number peaked on October 15, and at that time the number of events in that group was greater than in all others. A day after the beginning of the geomagnetic disturbance, REP of the 1st group appeared. These were the most numerous events on October 12. The decrease in the level of geomagnetic disturbance was accompanied by a decrease in the occurrence rate of events in all groups. Daily average precipitation flux also varied during the interval. The events of the third group had the greatest flux on October 11, i.e., at the beginning of the storm main phase. Then their flux decreased. The flux of second group events increased by October 11, still remaining lower than the flux of the third group events, and the remained almost constant until the end of the interval. During the period from October 13 to October 15, the flux in the first group events remained at its maximum value. By October 16, the REP fluxes in all three groups became comparable. The distribution of REP as a function of latitude and MLT is consistent with previously established statistics. An analysis of energetic proton precipitation was also carried out for this interval.The temporal evolution of the precipitation events reflects the processes developed in the magnetosphere at different phases of magnetic storm. One can see the partial ring current formation at the main phase, corresponding the EMIC waves generation and the 3rd group precipitation. Also, multiple substorms produce the magnetic field distortion in the night-side magnetosphere. They were responsible for the 1st group precipitation during the main and recovery phases.

[1] A.G.Yahnin, T.A. Yahnina, N.V. Semenova, B.B. Gvozdevsky and A.B. Pashin J. Geophys. Res. Space Physics 121 (2016).

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